



Acquiring Stryker's Software — A Success Story

COL R. David Ogg Jr. and Magid Athnasios

In October 1999, Army leaders announced their vision for the future, which included an immediate and urgently needed air-transportable brigade combat team (BCT) capable of deployment anywhere on the globe in a combat-ready configuration. This force was deemed essential for providing the strategic responsiveness and full-spectrum versatility demanded by the *National Military Strategy*. Pursuant to the Army Systems Acquisition Review Council, Defense Acquisition Board and Defense Acquisition Executive approvals, the contract for the Stryker Family of Vehicles (SFoV) was awarded in November 2000. This article highlights the software management efforts leading to the successful February 2004 Milestone III decision.

The SFoV, and specifically, the Stryker BCT, fulfill the need for a rapidly deployable and modular force to improve the operational effectiveness of rapid-response, early-entry forces. Stryker systems provide a full range of safe, reliable, supportable and effective systems envisioned by the BCT Organizational and Operational Concept, and support the development, acquisition and program management framework to transform the Army from the Current to Future Force.

The SFoV comprises 10 mission-oriented configurations:

- Mobile Gun System (MGS).
- Infantry Carrier Vehicle (ICV).
- Reconnaissance Vehicle.
- Anti-Tank Guided Missile Vehicle (ATGM).
- Fire Support Vehicle.
- Engineer Squad Vehicle (ESV).
- Command and Control Vehicle (CV).
- Medical Evacuation Vehicle.
- Nuclear, Biological and Chemical Reconnaissance Vehicle (NBCRV).
- Mortar Carrier Vehicle (MC).

The Stryker is a 19-ton wheeled vehicle optimized for operations within close, complex and urban terrain and can be deployed by C-130 aircraft. It is capable of transporting a 9-man rifle squad and is configured with a remote weapons station (RWS) with universal gun mount supporting a variety of weapons to include the Mark 19 Mod 3 Grenade Machine Gun, M2HB .50cal Machine Gun and M240 7.62mm Machine Gun. The Stryker sports run-flat tires, has 14.5 millimeters of all-around armor protection, gets 5.7 miles per gallon of fuel and has a low acoustic signature. Additionally, the Stryker has a self-recovery winch and many common parts across all variants.

Each variant can be set up in multiple subconfigurations by altering vehicle command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) and mission equipment packages. Each variant has a common wiring and mounting architecture for installing onboard C4ISR equipment. In addition to the C4ISR, there are a number of software systems developed specifically for the SFoV as follows:

Lethality:

- RWS for the ICV, CV, ESV, MC and NBCRV.
- Modified Improved Target Acquisition System for the ATGM only.
- Programmable Interface Controller for the ATGM only.
- Platform System Controller for the ATGM only.

Deployability/Survivability:

- Height Management Unit, all variants.

Mobility:

- Power Pack Interface, all variants.

Sustainability:

- Diagnostic Control Unit, all variants.

Versatility/Agility/Responsiveness:

- Climate Control Unit, all variants.
- Gauge Cluster Unit, all variants.
- Video Display Terminal, all variants.
- Embedded Trainer System for the ICV, CV, ESV, MC, NBCRV and MGS.

Contractor-developed software configuration items include low-level chassis controls, training, maintenance, weapon and soldier/machine interface

electronic systems, which have functionally specific user access and limited intravehicular interoperability.

There were several key elements employed for the successful software acquisition and development for the Stryker systems, including contract software requirements, the development process and standards, the acquisition team, an acquisition process focusing on integrated product teams (IPTs), working groups and communications and metrics, which include management and quality indicators.

Contract Software Requirements

The software scope of work addressed mission-critical computer resources and software support, and was mapped to the two main components of Stryker acquisition — production and development. These were aligned, directly implemented and mapped to the System Acquisition Strategy.

Eight of the 10 Stryker systems were categorized as production ready, and the MGS and the NBCRV were categorized as ongoing development efforts.

Development Process and Standards

The International Standards Organization (ISO)/Institute of Electrical and Electronics Engineers (IEEE) 12207 software process standard was implemented on the Stryker software effort, along with the requirement for the contractor(s) to be Software Engineering

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SGT Bonner, B Co., 1st Battalion, 24th Infantry Regiment (24th Inf. Reg.), 25th Infantry Division (Light) (25th ID(L)) Stryker Brigade Combat Team (SBCT), fires his M203 at a range south of Mosul, Iraq, Jan. 2, 2005. (U.S. Army photo by SGT Jeremiah Johnson, 55th Signal Co. (Combat Camera).)

Institute Software Capability Maturity Level 3 (or equivalent) certified. Early in the program, after start of work, a 2-day training session was held to baseline the contractor and government software proponents on the requirements of the ISO/IEEE 12207 standard. The five primary processes delineated in the ISO/IEEE 12207 standard, (acquisition, supply, development, operation and maintenance) along with the supporting processes, including documentation, configuration management, software quality assurance, verification, validation, joint reviews, audit and problem resolution were documented. In conjunction with the organizational processes, management, infrastructure and process improvement were documented. This was accomplished by applying a process definition assessment instrument to all process elements necessary to structure complete development, maintenance and use operations for software products and services.

A comprehensive planning effort focused on defining and selecting the appropriate metrics that best suited the two main categories of Stryker software — production-ready (modified/reuse code) and developed software.

The Acquisition Team

Relevant stakeholders were assembled to make up a comprehensive IPT, including program managers; user representatives; software engineers; logisticians; safety, test and evaluation specialists; Defense Contract Management Agency personnel; and contractors and subcontractors. An initial challenge was ensuring that the SFoV integrated all Army Battle Command System components, which made executing an optimum configuration management strategy for all subsystem software a massive effort. IPT members worked together to meticulously track all the subsystems' software versions and any changes made to ensure interoperability.

Beyond the synchronization stipulations outlined in the Army Software Blocking Policy, an Executive Review Panel, chaired by the deputy program executive officers (PEOs) for PEO Command,

Control and Communications Tactical (C3T) and PEO Ground Combat Systems (GCS), aided in facilitating the close coordination required to ensure the configuration status accounting and management essential for successful C4 interoperability. Program Manager (PM) BCT also established Memorandums of Agreement with each program management office in PEO C3T impacting Stryker vehicles.


Metrics

A comprehensive planning effort focused on defining and selecting the appropriate metrics that best suited the two main categories of Stryker software — production-ready (modified/reuse code) and developed software. A defined set of metrics — old but effective *Army Materiel Command Pamphlets 70-13 Management Indicator* and *70-14 Quality Indicators* — were used as the baseline for the software working group (SWG)/IPT to select from. For the production-ready software, the following metrics were used:

- Requirements Definition and Stability
- Software Progress (earned value)
- Computer Resource Utilization
- Trouble Reporting



Bravo Co. Soldiers, 1st Battalion, 24th Inf. Reg., 25th ID(L) SBCT, provide convoy escort to heavy haulers transporting 11D Bradley Fighting Vehicles and M1A1 Abrams tanks to Mosul, Iraq, Jan. 2, 2005. (U.S. Army photo by SGT Jeremiah Johnson, 55th Sig. Co. (Combat Camera).)



The 25th ID(L) SBCT "Tropic Lightning" Soldiers provide escort duty, Jan. 2, 2005, on a highway south of Mosul, Iraq. (U.S. Army photo by SGT Jeremiah Johnson, 55th Sig. Co. (Combat Camera).)

For developed software, the aforementioned measures were augmented with:

- Test Coverage
- Software Development Manpower

The contractors collected these software measures for each software item and reviewed them monthly at SWG meetings. Overall software schedule and metrics were then summarized and briefed to senior leaders at quarterly Stryker program reviews.

As software continues to become more prevalent in Army weapon systems, there has been a pronounced emphasis (even at the Congressional level via section 804,

FY03 National Defense Authorization Act — Improvement of Software Acquisition Processes), to implement software improvement programs. The DOD response sometimes defaults to "best practices" existing throughout the community.

The reality is that although there are many best practices, the key is to select and apply the practices that are truly relevant. Relevant practices are those that are based on consideration of the acquisition strategy, program management

and leadership and systems engineering. They simultaneously emphasize management and requirements tracking, and focus on total life-cycle aspects of system development, production, ma-

teriel release, deployment and sustainment. Open continuous communications were achieved through weekly telephone conferences and monthly software reviews, and played a key role in providing insight and feedback to all stakeholders.

For the Stryker software acquisition, the team achieved success by exercising relevant practices (standards and measures), along with early PM, PEO and prime contractor senior leaders atten-

tion and emphasis on software and its application to the Army's SFoV.

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